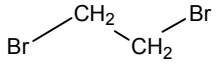
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)
CAS No. 106-93-4
First Listed in the *Second Annual Report on Carcinogens*



CARCINOGENICITY

1,2-Dibromoethane (ethylene dibromide) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC S.4, 1982; IARC S.7, 1987). When administered by gavage in corn oil, technical-grade 1,2-dibromoethane induced squamous cell carcinomas of the forestomach in rats of both sexes, hepatocellular carcinomas in females, and hemangiosarcomas in males. The same route of administration induced squamous cell carcinomas of the forestomach and alveolar-bronchiolar adenomas in mice of both sexes (NCI 86, 1978). When administered by inhalation, 1,2-dibromoethane induced increased incidences of carcinomas, adenocarcinomas, and adenomas of the nasal cavity and hemangiosarcomas of the circulatory system in male and female rats; mesotheliomas of the tunica vaginalis and adenomatous polyps of the nasal cavity in males; and fibroadenomas of the mammary gland and alveolar-bronchiolar adenomas and carcinomas in females. 1,2-Dibromoethane administered by inhalation induced alveolar-bronchiolar carcinomas and adenomas in mice of both sexes, and hemangiosarcomas, subcutaneous fibrosarcomas, carcinomas of the nasal cavity, and adenocarcinomas of the mammary gland in females (NTP 210, 1982). Topical application of 1,2-dibromoethane induced tumors of the skin, lung, and forestomach in mice (IARC S.4, 1982).

There are no adequate data available to evaluate the potential carcinogenicity of 1,2-dibromoethane in humans (IARC S.4, 1982; IARC S.7, 1987). An IARC Working Group determined that results from an epidemiological study which related occupational exposure to 1,2-dibromoethane with an increased incidence of malignant neoplasms were inconclusive.

PROPERTIES

1,2-Dibromoethane is a clear, colorless, volatile liquid with a characteristic sweet, chloroform-like odor. The compound is slightly soluble in water, and soluble in ethanol, ether, benzene, gasoline, and most organic solvents. 1,2-Dibromoethane is nonflammable and, under most conditions, is quite stable. On exposure to light, the colorless liquid turns brown, indicating slight decomposition. When heated to decomposition, 1,2-dibromoethane emits toxic fumes of hydrobromic acid and other brominated compounds.

USE

1,2-Dibromoethane has been used primarily as a lead scavenger in antiknock mixtures added to gasolines. Lead scavenging agents transform the combustion products of lead alkyls to forms that are more likely to be vaporized from engine surfaces. Annual consumption of 1,2-dibromoethane in the United States is decreasing due to EPA regulations limiting the use of lead in gasolines (NCI DCE, 1985g).

The second major commercial use of 1,2-dibromoethane has been as a pesticide and ingredient of soil and grain fumigant formulations (NCI DCE, 1985g). 1,2-Dibromoethane is mixed with an inert solvent for soil application as a nematocide and insecticide, and mixed with carbon tetrachloride and ethylene dichloride for use in combating insect infestations in stored grain and in grain milling machinery. Because of its effectiveness in the control of the Mediterranean fruit fly, 1,2-dibromoethane has been used for post-harvest application to beans, cantaloupe, bananas, citrus fruits, cucumbers, peppers, pineapples, papayas, and zucchini. In addition to being used as a tobacco pesticide, 1,2-dibromoethane has been applied after harvest on barley, corn, oats, popcorn, rice, rye, sorghum, potatoes, cotton, peanuts, and wheat (Chem. Eng. News, 1984d). 1,2-Dibromoethane was also employed to fumigate fallen logs (Chem. Eng. News, 1984e). By the mid-1980s EPA regulations had eliminated approximately 97% of the use of 1,2-dibromoethane as a pesticide in the United States. The remaining 3% was used as a quarantine fumigant on fresh citrus and other tropical fruits, produced in the United States or imported (NCI DCE, 1985g). Ethylene dibromide was listed in 1997 as "banned"- all registered pesticide uses have been prohibited by final government action (USEPA, 1997).

Minor uses of 1,2-dibromoethane include use as a chemical intermediate in synthesis and as a nonflammable solvent for resins, gums, and waxes. The major chemical made from 1,2-dibromoethane is probably vinyl bromide, which is used as a flame retardant in modacrylic fibers (NCI DCE, 1985g). 1,2-Dibromoethane also has been used as an intermediate in the preparation of dyes and pharmaceuticals (NIOSH 37, 1981).

PRODUCTION

The 1997 *Directory of Chemical Producers* identified two producers of 1,2-dibromoethane (SRIa, 1997), and the 1998 Chemical Buyers Directory listed one domestic supplier of the compound (Tilton, 1997). Since 1984 the USITC has listed two manufacturers of ethylene dibromide for almost every year (USITC, 1985-1990, 1993, 1995); production volumes were not disclosed. Data on production of the compound are not available after 1984 (ATSDR, 1992-R039). However, the EPA (OPPT) High Production Volume Chemicals list gave a production volume range of 52.9 to 75.3 million Lb (USEPA, 1997) In 1990 and 1992, one producer was reported (USITC, 1991, 1994).). As a result of EPA regulations banning its use as a pesticide, and reduced antiknock use, 1,2-dibromoethane has experienced a sharp decline in production. 1,2-Dibromoethane exports in 1985 totaled 1.1 million lb (USDOC Exports, 1986), but import figures for that year were not available. OSHA estimated that total 1984 U.S. production of 1,2-dibromoethane was 152 million lb. 1,2-Dibromoethane imports in 1984 exceeded 26 million lb and exports were approximately 1.5 million lb. Domestic 1,2-dibromoethane production amounted to 155 million lb in 1983 and 170 million lb in 1982 (USITC, 1984, 1983). In 1981, 169 million lb of 1,2-dibromoethane were produced in the United States (USITC, 1982). From 1977 to 1981 U.S. imports have fluctuated with a high of 0.861 million lb in 1980 and a low of 0.079 million lb in 1979 (ATSDR, 1992-R039). Export levels, however, have been declining. In 1981, the United States exported 29.8 million lb of 1,2-dibromoethane, which is very low compared to the 1978 quantity of 84.8 million lb (ATSDR, 1992-R039One producer reported a total production of 70 million lb of 1,2-dibromoethane in 1979, of which 20 million lb were used for pesticides and roughly 50 million lb were used in gasoline. The 1979 TSCA Inventory identified four companies producing 375 million lb and three companies importing 1.1 million lb in 1977. The CBI Aggregate was between 100 million and 1 billion lb (TSCA, 1979). Production of 1,2-dibromoethane was first reported in the United States in 1923 (IARC V.15, 1977).

EXPOSURE

The primary routes of potential human exposure to 1,2-dibromoethane are inhalation, ingestion, and dermal contact. A potential for occupational exposure to 1,2-dibromoethane exists during its manufacture; use in the synthesis of other chemicals; use as a fumigant; and from handling, ingesting, or otherwise using products that contain 1,2-dibromoethane (e.g., citrus fruits, grain, leaded gasoline) (NCI DCE, 1985g). Current exposures, however, are expected to be significantly lower than historical levels, since uses of the chemical are now being limited (NCI DCE, 1985g; ATSDR, 1992-R039). A NIOSH-sponsored industrial hygiene survey was conducted at a 1,2-dibromoethane production facility to determine the 8-hr time-weighted average (TWA) exposure to the compound. Personal samples were taken from workers in job classifications associated with exposure to 1,2-dibromoethane. Median 8-hr TWA concentrations were: control room operator, 0.04 ppm (range 0.003 to 0.16 ppm); crew leader (foreman), 0.50 ppm (0.04-0.95 ppm); loader (tank car), 0.36 ppm (0.05-0.62 ppm); and laboratory technician (quality assurance), 0.05 ppm (0.01-0.08 ppm). These data indicate that the tank car loading and crew leader activities present the highest risks of exposure to 1,2-dibromoethane (NCI DCE, 1985g).

An industrial hygiene survey of a 1,2-dibromoethane-user facility, where 1,2-dibromoethane is blended with tetramethyllead and other chemicals in the production of gasoline antiknock compounds, was also sponsored by NIOSH. Personal monitoring resulted in median 8-hr TWA concentrations of 0.022 ppm for blend operators (0.004 to 0.058 ppm), 0.0002 ppm for shift superintendent (0.0001 to 0.0004 ppm), and 0.004 ppm for laboratory technicians (0.0002 to 0.012 ppm). Personal monitoring data from other 1,2-dibromoethane and gasoline antiknock mixture blending plants also indicate that the greatest potential for 1,2-dibromoethane exposure is related to open system operations such as loading, unloading, and sample collection. Lower TWA exposures to 1,2-dibromoethane appear to be associated with 1,2-dibromoethane production rather than with antiknock blending operations, but mixed chemical exposure is more likely with the latter processes. Worker exposure during use of 1,2-dibromoethane has been studied in preplant soil fumigation, quarantine fumigation, and spot treatment of flour mill equipment (NCI DCE, 1985g).

Two types of mixing and loading systems are employed during soil fumigation. Closed systems reduce the amount of vapor emitted to the worker breathing zone, and therefore, exposure by this route is reduced as compared to open systems. Dermal exposure during most soil fumigation operations is negligible. Personal protective equipment is required and usually worn during the transfer of 1,2-dibromoethane. The duration of exposure during transfer and application varies widely and results in varying estimated annual exposure doses for persons working with different commodities. Historically, annual exposure levels encountered in decreasing order have been potatoes > miscellaneous vegetables and fruits > pineapples > cotton > tobacco > peanuts > fruit trees = citrus. A minor use, but one for which applicants receive large exposures to 1,2-dibromoethane, is in the fumigation of felled logs (Chem. Eng. News, 1984e).

OSHA has suggested that while the population of service station workers potentially exposed to 1,2-dibromoethane is very large, the actual levels of exposure may be very small (NCI DCE, 1985g). Emission samples taken in areas adjacent to gas stations and traffic arteries contained concentrations of 1,2-dibromoethane ranging from 0.07 to 0.11 $\mu g/m^3$ (NCI DCE, 1985g).

1,2-Dibromoethane has been widely released to the environment from its historical use as a gasoline additive and a fumigant. Its persistence in soil and groundwater has led to its detection

in ambient air, soil, groundwater, and food (ATSDR, 1992-R039). The Toxic Chemical Release Inventory (EPA) listed 33 industrial facilities that produced, processed, or otherwise used 1,2-dibromoethane in 1988 (TRI, 1990). In compliance with the Community-Right-to-Know Program, the facilities reported releases of 1,2-dibromoethane to the environment which were estimated to total 63,000 lb.

For the general population, exposure to 1,2-dibromoethane through ingestion of contaminated drinking water is the most important route. EPA, in a 1985 report, estimated the daily intake from drinking water to range from 0 to 16 µg/kg. Ingestion of contaminated foods and inhalation of ambient air appear to be less important sources of exposure to 1,2-dibromoethane. EPA estimated the maximum intake from the former to be 0.09 µg/kg/day and from the latter to range from 0 to 79 µg/kg/day. However, inhalation of 1,2-dibromoethane released to indoor air from contaminated groundwater, such as while showering, may play an important role in human exposure (ATSDR, 1992-R039).

REGULATIONS

In 1980 CPSC preliminarily determined that 1,2-dibromoethane was not present in consumer products under its jurisdiction. Subsequently, public comment was solicited to verify the accuracy of this information; no comments were received. Pending receipt of this new information, CPSC plans no action on this chemical. EPA regulates 1,2-dibromoethane under the Clean Air Act (CAA), Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Food, Drug, and Cosmetic Act (FD&CA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and Resource Conservation and Recovery Act (RCRA). Under CAA, 1,2-dibromoethane has been listed among substances that are potential human health hazards and for which specific technologies are defined. A reportable quantity (RQ) of 1,000 lb has been established under CWA. EPA has lowered the RQ to 1 lb under CERCLA. Under FD&CA, EPA has announced a policy compliance guide for residues of 1,2-dibromoethane on processed grain. Tolerances and exemptions for 1,2-dibromoethane residues in food and on animal feed have been established. Tolerances for residues of inorganic bromides on or in mangoes, citrus fruit, and papayas fumigated post harvest with 1,2-dibromoethane were revoked in a final rule. EPA has issued a notice of Rebuttable Presumption Against Registration (RPAR) for 1,2-dibromoethane under FIFRA, and it has been deleted from listing as a fumigant. RCRA subjects the chemical's waste products, off-specification batches, and spill residues to handling and report/recordkeeping requirements. Under SDWA, EPA has proposed a maximum contaminant level goal (MCLG) of zero (0 mg/L) and a maximum contaminant level (MCL) of 0.00005 mg/L. FDA has established tolerances and action levels for 1,2-dibromoethane residues on food and feed. NIOSH has recommended 0.045 ppm 10-hr TWA as REL with a ceiling exposure (15 min) of 0.13 ppm in the workplace. OSHA adopted a permissible exposure limit (PEL) of 20 ppm as an 8-hr TWA, with a 30-ppm ceiling and 50-ppm maximum peak for 5 minutes in an 8-hr time period; this standard was adopted for toxic effects other than cancer. OSHA proposed to lower the PEL for 1,2-dibromoethane and to include requirements for exposure monitoring, medical surveillance, employee information and training, and other provisions to protect employees from carcinogenic and other toxic effects. OSHA regulates 1,2-dibromoethane under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-38.